

Spontaneous Parametric down conversion in 1 D photonic crystals

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We report calculations on spontaneous parametric down-conversion in multilayer structures showing the possibility of tailoring the photon-pair spectrum for quantum information applications. Despite of what happens for homogeneous media, phase matching conditions are not crucial and the role played by phase matching conditions is weaker than the contribution due to field's overlap for finite size photonic crystals. This behaviour makes it possible to select a given non linear process to be extremely efficient while suppressing all the others. We simulated the spontaneous process by adding a white noise to the equation for the signal field and observing the generation of the idler. We performed a scan over the allowed frequencies and in a regime of very low conversion efficiency the results represent the spectrum of down converted photon pairs. We show that twin photon generation can occur in both forward and backward direction with narrow bandwidth and high brightness per mode if the device is properly designed. We also developed a quantum model in agreement with the semi-classical approach.